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OPERATING METHOD FOR FUEL CELL POWER GENERATION SYSTEM AND INVERTER DEVICE FOR FUEL CELL BY USING THIS AND FUEL CELL POWER GENERATION SYSTEM

Patent number:	JP7142079
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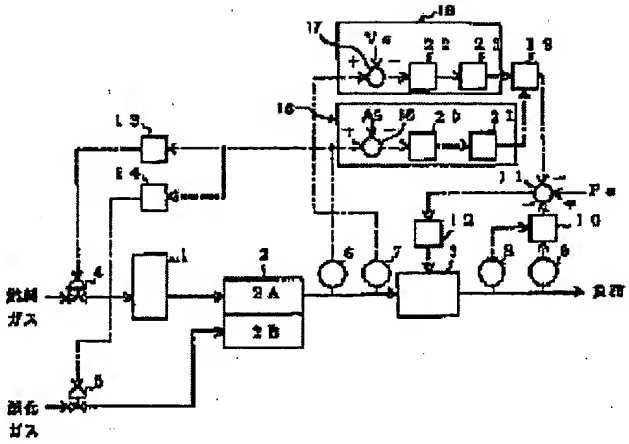
Inventor:	YAMADA KATSUKUNI; others: 02
Applicant:	HITACHI LTD; others: 01
Classification:	
- International:	H01M8/04
- european:	
Application number:	JP19930292141 19931122
Priority number(s):	

Abstract of **JP7142079**

PURPOSE:To provide a fuel cell power generation system by which the increase in a fuel cell output current can be prevented and with which control-protection setting maintenance by the performance degradation can be dispensed by restricting output electric power when the performance of a fuel cell body is degraded.

CONSTITUTION:An electric current allowable value As and/or a voltage allowable value Vs of DC output are set beforehand according to an initial characteristic of a fuel cell 2. When detecting values of an electric current detector 6 and a voltage detector 7, exceed allowable values As and Vs in operation, restraint computing units 16 and 18 find a restraining quantity of AC output. A deviation computing unit 11 restrains an output preset value Ps designated from outside by the restraining quantity. A DC-AC converter-controller 12 controls so that AC output of a DC-AC converter 3 becomes an output preset value after the restraint.



OPERATING METHOD FOR FUEL CELL POWER GENERATION SYSTEM AND INVERTER DEVICE FOR FUEL CELL BY USING THIS AND FUEL CELL POWER GENERATION SYSTEM

Legal status (INPADOC) of **JP7142079**

No legal data found.

JAPANESE [JP,07-142079,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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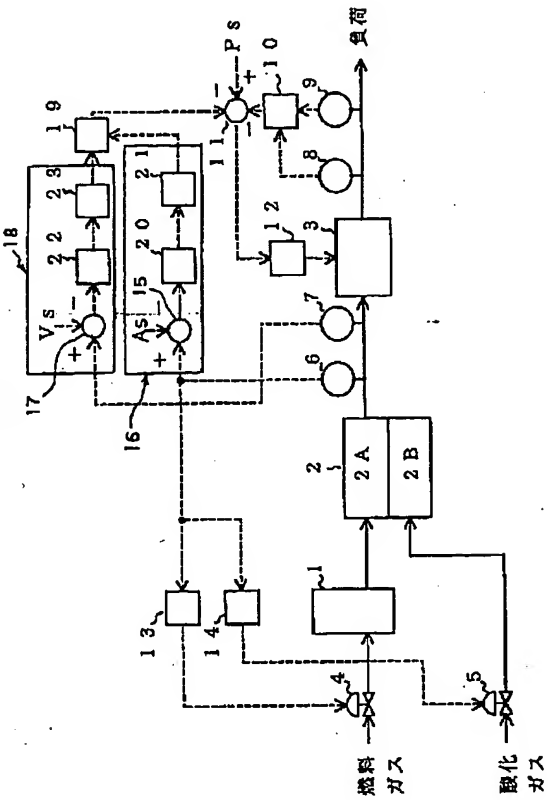
CLAIMS

[Claim(s)]
[Claim 1] In the inverter equipment for fuel cells which changes into an ac output the dc output which a fuel cell generates An inverter means to output the ac output which was equipped with the function to change into an ac output the dc output which the above-mentioned fuel cell generates, received the output request from the outside (the demanded this output value is hereafter called "output set point"), and balanced this output set point, An output state detection means to detect the condition of the dc output of the above-mentioned fuel cell About the dc output which (the detected this output state being hereafter called "detection output state") and the above-mentioned fuel cell generate It has the range of the output state defined beforehand (henceforth "output tolerance"). When this output tolerance is compared with the above-mentioned detection output state and the above-mentioned detection output state is outside the above-mentioned output tolerance as a result of this comparison It has a control means to control the above-mentioned output set point so that the above-mentioned dc output of the above-mentioned fuel cell may become in the above-mentioned output tolerance. The above-mentioned inverter means Inverter equipment for fuel cells characterized by being what outputs the ac output corresponding to the output set point (henceforth the "control output set point") controlled by the above-mentioned control means.
[Claim 2] The above-mentioned control means is inverter equipment for fuel cells according to claim 1 characterized by being what is equipped with control limiting value and performs the above-mentioned control within the limit of this control limiting value.
[Claim 3] The above-mentioned output tolerance is inverter equipment for fuel cells according to claim 1 characterized by being what determined based on the initial property of the above-mentioned fuel cell.
[Claim 4] The above-mentioned output tolerance is inverter equipment for fuel cells according to claim 1 characterized by defining the upper limit of the current of the above-mentioned dc output.
[Claim 5] The above-mentioned output tolerance is inverter equipment for fuel cells according to claim 1 characterized by defining the minimum of the electrical potential difference of the above-mentioned dc output.
[Claim 6] Inverter equipment for fuel cells according to claim 2 characterized by having further an information means to report this fact when the above-mentioned control output set point reaches the above-mentioned control limiting value.
[Claim 7] The fuel cell which generates a dc output, and the fuel gas feeder which supplies fuel gas to the above-mentioned fuel cell, By receiving the oxidation gas transfer unit which supplies oxidation gas to the above-mentioned fuel cell, and the output request from the outside (the demanded this output value being hereafter called "output set point"), and changing into an ac output the dc output which the above-mentioned fuel cell generated The inverter equipment which outputs the ac output corresponding to the above-mentioned output set point outside, The current detector which detects the direct current which is outputting the above-mentioned fuel cell (the detected this current value is hereafter called "detection current value"), When it has the current allowed value defined beforehand, this current allowed value is compared with the above-mentioned detection current value and the above-mentioned detection current value is over the above-mentioned current allowed value as a result of this comparison It is the fuel cell generation-of-electrical-energy system which is equipped with the restraint controlled so that the above-mentioned output set point may be reduced, and is characterized by the above-mentioned inverter equipment being what

outputs outside the ac output corresponding to the output set point (henceforth the "control output set point") controlled by the above-mentioned restraint.
[Claim 8] The above-mentioned current allowed value is a fuel cell generation-of-electrical-energy system according to claim 7 characterized by being set up based on the initial property of the above-mentioned fuel cell.
[Claim 9] The fuel cell which generates a dc output, and the fuel gas feeder which supplies fuel gas to the above-mentioned fuel cell, By receiving the oxidation gas transfer unit which supplies oxidation gas to the above-mentioned fuel cell, and the output request from the outside (the demanded this output value being hereafter called "output set point"), and changing into an ac output the dc output which the above-mentioned fuel cell generated The inverter equipment which outputs the ac output corresponding to the above-mentioned output set point outside, The electrical-potential-difference detector which detects the direct current voltage which is outputting the above-mentioned fuel cell (the detected this electrical-potential-difference value is hereafter called "detection electrical-potential-difference value"), When it has the electrical-potential-difference allowed value defined beforehand, this electrical-potential-difference allowed value is compared with the above-mentioned detection electrical-potential-difference value and the above-mentioned detection electrical-potential-difference value is less than the above-mentioned electrical-potential-difference allowed value as a result of this comparison It is the fuel cell generation-of-electrical-energy system which is equipped with the restraint controlled so that the above-mentioned output set point may be reduced, and is characterized by the above-mentioned inverter equipment being what outputs outside the ac output corresponding to the output set point (henceforth the "control output set point") controlled by the above-mentioned restraint.
[Claim 10] The above-mentioned electrical-potential-difference allowed value is a fuel cell generation-of-electrical-energy system according to claim 9 characterized by being set up based on the initial property of the above-mentioned fuel cell.
[Claim 11] The above-mentioned restraint is a fuel cell generation-of-electrical-energy system according to claim 7 or 9 characterized by having further at least the halt controller which stops the generation of electrical energy by the above-mentioned fuel cell when it has the control limiting value which shows the limit of the above-mentioned control and the width of face of the above-mentioned control becomes more than this control limiting value.
[Claim 12]

Drawing selection Representative drawing

図1



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the fuel cell generation-of-electrical-energy system aiming at reduction of an installation cost and operation cost, and its operating method.
[0002]
[Description of the Prior Art] The fuel cell which generates electricity using the electrochemical reaction of fuel gas and oxidation gas attracts attention from the height of the conversion efficiency to the electrical energy, and cleanness, and development is furthered.
[0003] It explains using a typical fuel cell generation-of-electrical-energy system and the typical control approach drawing 5 .
[0004] A fuel cell generation-of-electrical-energy system looks like [the inverter unit 3 connected to the fuel reformer 1 by which piping connection was made, the oxidation gas control valve 5 which controls the flow rate of oxidation gas, such as air, and a fuel reformer 1 and an oxidation gas control valve 5 at the direct-current outgoing end of the body 2 of a fuel cell by which piping connection was made, and the body 2 of a fuel cell at the fuel-gas control valve 4 which controls the flow rate of fuel gas, such as town gas, and this fuel-gas control valve 4 and the controlling mechanism which mention later], and is constituted more.
[0005] In the fuel reformer 1, after reforming of the fuel gas supplied from the outside is carried out to a reforming fuel with high hydrogen concentration using a steam reforming process etc., it is supplied to fuel electrode 2A of the body 2 of a fuel cell. On the other hand, the oxidation gas supplied from the outside is supplied to air pole 2B of the body 2 of a fuel cell.
[0006] By the body 2 of a fuel cell, the reforming fuel of the specified quantity supplied by doing in this way and the oxidation gas of the specified quantity are made to react electrochemically, and direct current power is generated. After this direct current power is changed into predetermined alternating current power by the inverter unit 3, it is supplied to a load by it.
[0007] Next, the operation control of this fuel cell is explained.
[0008] Fundamentally, it is performed by adjusting the supply flow rate of fuel gas required for the body 2 of a fuel cell to generate the direct current power corresponding to this, and oxidation gas, control controlling an ac output by the inverter unit 3.
[0009] Control of an ac output is explained first.
[0010] AC power transducer 10 calculates the value of the power actually outputted to the load at the time based on the output signal of the alternating-voltage detector 8, and the output signal of the alternating current detector 9, and outputs this to the deflection computing element 110. The deflection computing element 110 calculates the deflection of the output set point Ps of an inverter unit 3, and the actual alternating current power output value which AC power transducer 10 calculated, and outputs the result (deflection) to the inverter unit output-control machine 12. The inverter unit output-control machine 12 performs a predetermined operation based on the signal of this deflection, and controls the phase and electrical potential difference of an ac output of an inverter unit 3.
[0011] Next, control of the supply flow rate of the oxidation gas to the body 2 of a fuel cell and fuel gas is explained.
[0012] A fuel gas flow rate required for a fuel cell to carry out a continuation generation of electrical energy

and an oxidation quantity of gas flow are proportional to the direct-current output current of a fuel cell. Therefore, supply control of flow of the fuel gas to the body 2 of a fuel cell and oxidation gas is performed based on the direct-current value of a fuel cell.

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PRIOR ART

[Description of the Prior Art] The fuel cell which generates electricity using the electrochemical reaction of fuel gas and oxidation gas attracts attention from the height of the conversion efficiency to the electrical energy, and cleanness, and development is furthered.
[0003] It explains using a typical fuel cell generation-of-electrical-energy system and the typical control approach drawing 5 .
[0004] A fuel cell generation-of-electrical-energy system looks like [the inverter unit 3 connected to the fuel reformer 1 by which piping connection was made, the oxidation gas control valve 5 which controls the flow rate of oxidation gas, such as air, and a fuel reformer 1 and an oxidation gas control valve 5 at the direct-current outgoing end of the body 2 of a fuel cell by which piping connection was made, and the body 2 of a fuel cell at the fuel-gas control valve 4 which controls the flow rate of fuel gas such as town gas, and this fuel-gas control valve 4, and the controlling mechanism which mention later], and is constituted more.
[0005] In the fuel reformer 1, after refining of the fuel gas supplied from the outside is carried out to a refining fuel with high hydrogen concentration using a steam reforming process etc., it is supplied to fuel electrode 2A of the body 2 of a fuel cell. On the other hand, the oxidation gas supplied from the outside is supplied to air pole 2B of the body 2 of a fuel cell.
[0006] By the body 2 of a fuel cell, the refining fuel of the specified quantity supplied by doing in this way and the oxidation gas of the specified quantity are made to react electrochemically, and direct current power is generated. After this direct current power is changed into predetermined alternating current power by the inverter unit 3, it is supplied to a load by it.
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[0008] Fundamentally, it is performed by adjusting the supply flow rate of fuel gas required for the body 2 of a fuel cell to generate the direct current power corresponding to this, and oxidation gas, control controlling an ac output by the inverter unit 3.
[0009] Control of an ac output is explained first.
[0010] AC power transducer 10 calculates the value of the power currently actually outputted to the load at the event based on the output signal of the alternating-voltage detector 8, and the output signal of the alternating current detector 9, and outputs this to the deflection computing element 110. The deflection computing element 110 calculates the deflection of the output set point Ps of an inverter unit 3, and the actual alternating current power output value which AC power transducer 10 calculated, and outputs the result (deflection) to the inverter unit output-control machine 12.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the fuel cell generation-of-electrical-energy system aiming at reduction of an installation cost and operation cost, and its operating method.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, it is not necessary to expect a part for the performance degradation of a fuel cell, and to adopt a large size and a mass facility device beforehand. Therefore, an initial cost can be reduced. in order that [moreover,] there may be no need of maintaining suitably control / protection setting out of electric installation -- operation cost -- easy -- ** and stable operation can be performed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As a practical big problem of a fuel cell, the performance degradation produced by catalyst sintering, electrolyte scattering, etc. occurs. An electrical potential difference when having taken out the fixed current falls with advance of such performance degradation as the current-voltage characteristic curve of drawing 6 also shows. This means that the output power of a fuel cell declines by the voltage drop.

[0014] In the conventional fuel cell generation-of-electrical-energy system, even when such performance degradation arose, it was going to maintain fixed output power. That is, when the body of a fuel cell deteriorated and direct-current output voltage declined, the generation-of-electrical-energy output was secured by increasing the amount of supply of fuel gas and oxidation gas, and making the direct-current output current increase.

[0015] However, in this way, also in the state of degradation, in order to enable it to secure a fixed output, the conditioning of control and protection of electric installation needed to be suitably maintained according to advance of degradation, and it had become the cause of a rise of operation cost. Moreover, only the part which expected a part for the performance degradation of the body of a fuel cell had to large-capacity[large-sized and]-ize the facility device specification beforehand, and had the problem of the facility cost of a fuel cell generation-of-electrical-energy system going up.

[0016] This invention aims at offering the operating method of the fuel cell generation-of-electrical-energy system which held down operation cost and facility cost and the inverter equipment for fuel cells using this, and a fuel cell generation-of-electrical-energy system.

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MEANS

[Means for Solving the Problem] This invention is what was made in order to attain the above-mentioned purpose. As the 1st mode In the inverter equipment for fuel cells which changes into an ac output the dc output which a fuel cell generates An inverter means to output the ac output which was equipped with the function to change into an ac output the dc output which the above-mentioned fuel cell generates, received the output request from the outside (the demanded this output value is hereafter called "output set point"), and balanced this output set point, An output state detection means to detect the condition of the dc output of the above-mentioned fuel cell About the dc output which (the detected this output state being hereafter called "detection output state") and the above-mentioned fuel cell generate It has the range of the output state defined beforehand (henceforth "output tolerance"). When this output tolerance is compared with the above-mentioned detection output state and the above-mentioned detection output state is outside the above-mentioned output tolerance as a result of this comparison It has a control means to control the above-mentioned output set point so that the above-mentioned dc output of the above-mentioned fuel cell may become in the above-mentioned output tolerance. The above-mentioned inverter means The inverter equipment for fuel cells characterized by being what outputs the ac output corresponding to the output set point (henceforth the "control output set point") controlled by the above-mentioned control means is offered.
[0018] In this case, the above-mentioned control means may be equipped with control limiting value, and may perform the above-mentioned control within the limit of this control limiting value.
[0019] As for the above-mentioned output tolerance, it is desirable that it is what is determined based on the initial property of the above-mentioned fuel cell.
[0020] The above-mentioned output tolerance may define the upper limit of the current of the above-mentioned dc output.
[0021] The above-mentioned output tolerance may define the minimum of the electrical potential difference of the above-mentioned dc output.
[0022] When the above-mentioned control output set point reaches the above-mentioned control limiting value, it is desirable to have further an information means to report this fact.
[0023] The fuel gas feeder which supplies fuel gas to the fuel cell which generates a dc output, and the above-mentioned fuel cell as the 2nd mode of this invention, By receiving the oxidation gas transfer unit which supplies oxidation gas to the above-mentioned fuel cell, and the output request from the outside (the demanded this output value being hereafter called "output set point"), and changing into an ac output the dc output which the above-mentioned fuel cell generated The inverter equipment which outputs the ac output corresponding to the above-mentioned output set point outside, The current detector which detects the direct current which is outputting the above-mentioned fuel cell (the detected this current value is hereafter called "detection current value"), When it has the current allowed value defined beforehand, this current allowed value is compared with the above-mentioned detection current value and the above-mentioned detection current value is over the above-mentioned current allowed value as a result of this comparison It has the restraint controlled so that the above-mentioned output set point may be reduced. The above-mentioned inverter equipment The fuel cell generation-of-electrical-energy system characterized by being what outputs outside the ac output corresponding to the output set point (henceforth the "control output set point") controlled by the above-mentioned restraint is offered.
[0024] In this case, as for the above-mentioned current allowed value, it is desirable to be set up based on

the initial property of the above-mentioned fuel cell.

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OPERATION

[Function] The inverter means has changed into the ac output the dc output which a fuel cell generates so that the ac output corresponding to the output set point specified from the outside may be outputted.
[0030] When a detection output state is compared with output tolerance and the above-mentioned detection output state is outside the above-mentioned output tolerance as a result of this comparison, a control means controls the above-mentioned output set point so that the above-mentioned dc output of the above-mentioned fuel cell may become in the above-mentioned output tolerance.
[0031] An inverter means outputs the ac output corresponding to the output set point (control output set point) controlled by the above-mentioned control means.
[0032] In this case, if this output tolerance is made into the upper limit of a current determined based on the initial property of a fuel cell, or the lower limit of an electrical potential difference, the current value to which the fuel cell exceeded the initial engine performance (namely, maximum performance about the fuel cell concerned) will not be required.
[0033] In addition, it may be made to perform control within the limit of control limiting value. Moreover, when the width of face of control exceeds the above-mentioned control limiting value, a halt controller stops the generation of electrical energy by the fuel cell.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained using a drawing.
[0035] The 1st example is explained using drawing 1 .
[0036] The configuration with the fundamental fuel cell generation-of-electrical-energy system of this example is the same as that of the conventional technique. That is, the inverter unit 3 connected to the fuel reformer 1 by which piping connection was made, the oxidation gas control valve 5 which controls the flow rate of oxidation gas, such as air, and the fuel reformer 1 and the oxidation gas control valve 5 at the direct-current outgoing end of the body 2 of a fuel cell by which piping connection was made, and the body 2 of a fuel cell at the fuel-gas control valve 4 which controls the flow rate of fuel gas, such as town gas, and this fuel-gas control valve 4, and the controlling mechanism which mention later resemble, and it is constituted more. And in the fuel reformer 1, after reforming of the fuel gas supplied from the outside is carried out to a reforming fuel with high hydrogen concentration using a steam reforming process etc., it is supplied to fuel electrode 2A of the body 2 of a fuel cell. On the other hand, the oxidation gas supplied from the outside is supplied to air pole 2B of the body 2 of a fuel cell. By the body 2 of a fuel cell, the reforming fuel of the specified quantity supplied by doing in this way and the oxidation gas of the specified quantity are made to react electrochemically, and direct current power is generated. After this direct current power is changed into predetermined alternating current power by the inverter unit 3, it is supplied to a load by it.
[0037] This example is characterized [greatest] by the point restricted so that an ac output may be controlled according to it, when the engine performance of a fuel cell deteriorates. Therefore, suppose that it explains focusing on this control in this or subsequent ones.
[0038] the control system of the inverter unit 3 in this fuel cell system -- the current detector 6, the electrical-potential-difference detector 7, the electrical-potential-difference detector 8, the current detector 9, the ac output calculation machine 1010, the deflection computing element 11, the output-control machine 12, the current base control computing element 16, the electrical-potential-difference base control computing element 18, and an adder 19 -- since -- it is mainly constituted.
[0039] The performance degradation of a fuel cell appears in the form of the fall of cell voltage, and also appears in the form of increase of the current value at the time of taking out a fixed output. Then, this example has detected performance degradation by supervising the electrical potential difference of the dc output which a fuel cell outputs, and a current value. In addition, detection of performance degradation based on a current value is performed by the current detector 6 and the current base control computing element 16 among the above-mentioned configurations. On the other hand, detection of performance degradation based on an electrical-potential-difference value is performed by the electrical-potential-difference detector 7 and the electrical-potential-difference base control computing element 18.
[0040] The current detector 6 is for detecting the current value of the dc output which has generated the fuel cell.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the 1st example of this invention.
[Drawing 2] It is the block diagram showing the 2nd example of this invention.
[Drawing 3] It is the block diagram showing the modification of the 2nd example of this invention.
[Drawing 4] It is the block diagram showing the 3rd example of this invention.
[Drawing 5] It is the block diagram showing the conventional fuel cell generation-of-electrical-energy system.

[Drawing 6] It is the output voltage-output current characteristic curve sheet of a fuel cell.
[Description of Notations]
1 [.. Air pole,] .... A fuel reformer, 2 .. The body of a fuel cell, 2A .. A fuel electrode, 2B 3 .... An inverter unit, 4 .. A fuel gas control valve, 5 .. Oxidation gas control valve, 6 [.. Current detector,] .... A current detector, 7 .. An electrical-potential-difference detector, 8 .. An electrical-potential-difference detector, 9 10 .... An ac output calculation machine, 11, 15, 17 .. A deflection computing element, 12 .. Output-control machine, 13 .... A fuel gas control-of-flow computing element, 14 .. Oxidation quantity-of-gas-flow control computing element, 16 .... A current base control computing element, 18 .. An electrical-potential-difference base control computing element, 19 .. Adder, 20 22 [.. 26 A control controller, 28 / .. 27 A pulse generator, 29 / .. A storage machine, 250 / .. A control monitor means, 252 / .. An annunciator, As / .. A current allowed value, Vs / .. Electrical-potential-difference allowed value] .... 21 Proportionality and a calculus computing element, 23 .. A limiter, 24 .. A multiplier, 25

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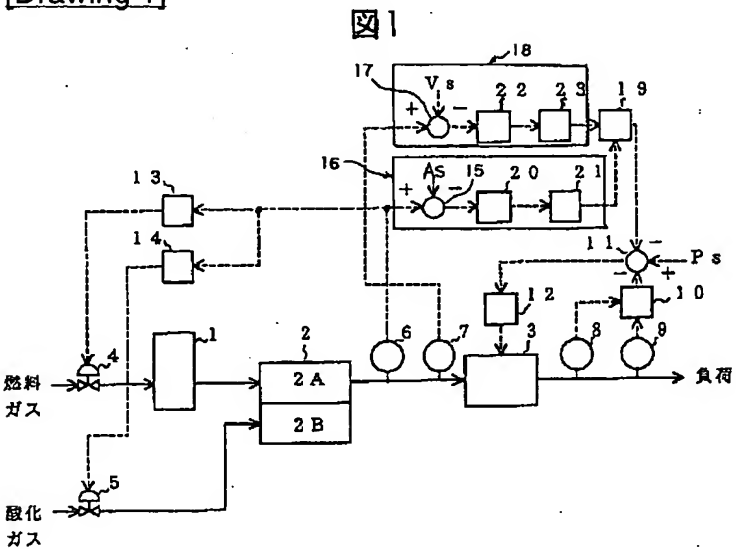
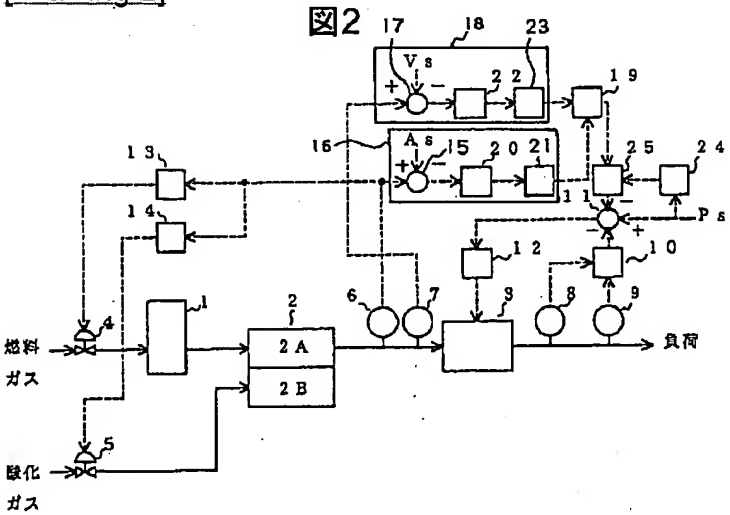
DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 4]

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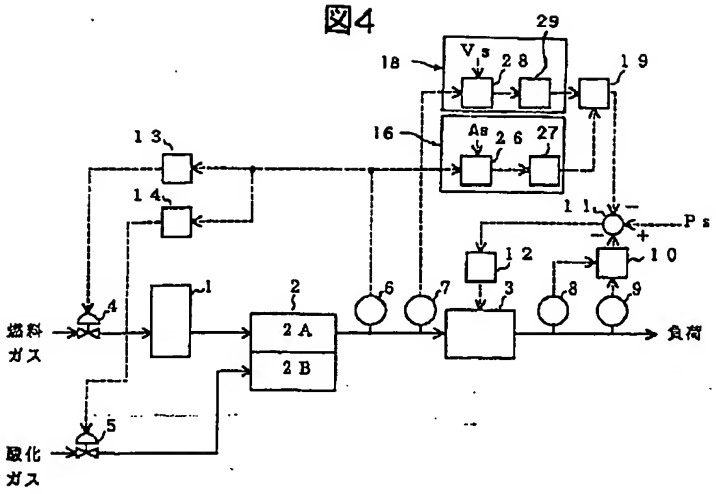

[Drawing 6]

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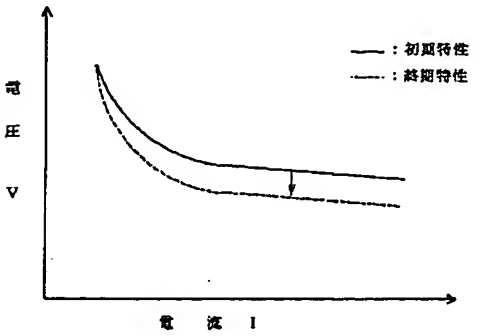
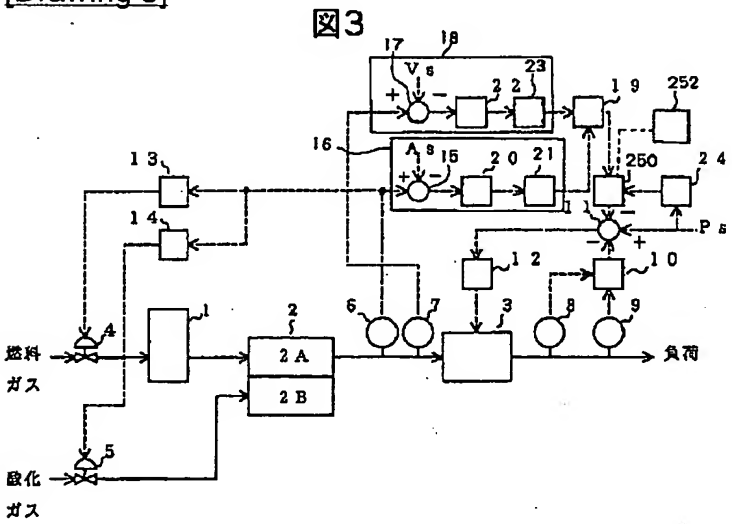


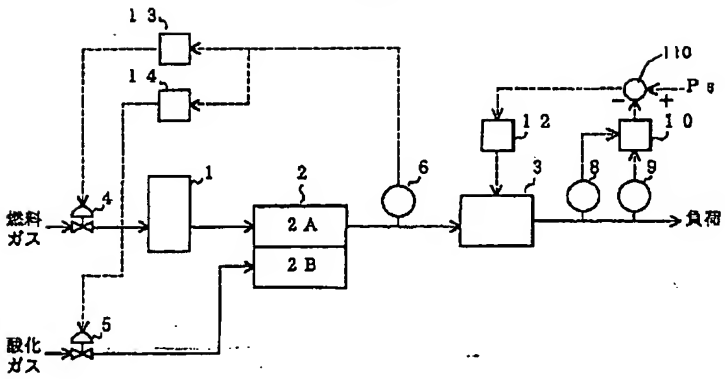
[Drawing 3]

図3



[Drawing 5]

図5



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